

WHAT IS CLAIMED IS:

1. Valve apparatus for controlling fluid flow, comprising a valve body having a central axis, a valve base having a first port and a second port in fluid communication with the first port, a valve seat disposed between the first and second ports for having fluid flow therethrough, a diaphragm mounted by at least one of the base and body and movable between a valve closed position blocking fluid through the valve seat from one of the ports to the other and a valve open position permitting fluid flow through the valve seat, said diaphragm having a central concave portion opening toward the valve seat, a button having a central axis and mounted for axial movement by the valve body for abutting against the diaphragm to move it from its open position to its closed position, said button having a first surface for abutting against the diaphragm, the button first surface in the valve open position having a central concave portion opening to the diaphragm central portion and an annular convexly curved portion joined to the concave portion and surrounding the concave portion for abutting against the diaphragm as the diaphragm is moved from its open position to its closed position and means for moving the button from its valve open position to its closed position.

2. The valve apparatus of claim 1 wherein the valve seat has an annular sealing surface for being abutted against the diaphragm when the diaphragm is in a valve closed position and the diameter of the juncture of convex curved portion to the button central portion is between the inner and outer diameters of the sealing surface.

3. The valve apparatus of claim 1 wherein in, a plane of the central axis and when the diaphragm is in its open position, the radius of curvature of the button central portion is greater than that of the button convex portion and in a plane perpendicular to the central axis, the radial dimension of the diaphragm central portion is substantially the same as the radial dimension of the diaphragm convex portion.

5. The valve apparatus of claim 1 wherein, in a valve open position, the button has a peripheral cylindrical surface that intersects with the convex surface and the convex surface are of a radii emanating from in a circle in a plane parallel to the above mentioned plane that the

intersection of the cylindrical surface with the convex surface remains out of contact with the diaphragm in both of its valve open and valve closed positions and during its movement between the valve open and valve closed portions.

5. The valve apparatus of claim 4 wherein the concave surface portion has an annular part intersected by said radii extending parallel to the central axis is of a transverse diameter that is about the same as one of the minimum diameter of the valve and a diameter intermediate that of inner and outer diameters of the valve seat.

6. The valve apparatus of claim 1 wherein the button concave portion is of a diameter about 15 to 25 percent of the outer diameter of the button in a plane perpendicular to the central axis.

7. The valve apparatus of claim 6 wherein, in a valve open position, the button has a peripheral cylindrical surface that intersects with the convex surface and the spacing of the intersection of the cylindrical surface with the convex surface in a plane perpendicular to the central axis and tangential to the annular convex surface portion most remote from the juncture of the concave surface to the convex surface is axially greater than the maximum axial spacing of the concave surface from said plane.

8. The valve apparatus of claim 1 wherein the button includes a central recess axially opposite the first surface and of a diameter at least substantially as large as the inner diameter of the valve seat, and said means includes a cylindrical insert mounted in the recess and a plunger of a smaller diameter than that of the insert and axially movably mounted by the valve body for moving the button from its valve open position to its valve closed position.

9. The valve apparatus of claim 8 wherein the plunger is of a smaller diameter than the inner diameter of the valve seat and the diameter of the concave portion is less than the inner diameter of the valve seat.

10. The valve apparatus of claim 1 wherein the valve body has a transverse terminal surface that includes a radial outer annular flat terminal edge portion that is generally planar in a plane perpendicular to the central axis and a radial inner, annular tapered portion that is

tapered radially inwardly and axially in a direction away from the valve seat, the diaphragm has a flat radial outer annular portion joined to its central portion and the base has an annular chamber opening to the diaphragm and to the first port and an annular rib surrounding the chamber and abutting against the flat portion for retaining the diaphragm in clamped relationship to the valve body terminal edge portion.

11. The valve apparatus of claim 8 wherein the button has a central recess opposite the diaphragm that is of a diameter greater than the diameter of the diaphragm central portion, a metal insert is mounted in the recess, and the above mentioned means includes a plunger mounted by the valve body for axial movement to abut against and move the insert and means is connected to the valve body and is operable for moving the plunger to move the insert and therethrough the button to move the diaphragm to its valve closed position.

12. The valve apparatus of claim 10 wherein the diaphragm has a surface that is engagable with the button concave surface, the diaphragm central portion in the plane of the central axis is of a radius of curvature that is substantially the same as that of the button concave portion and the button convex portion in the plane of the central axis is of a smaller radius of curvature than that of the button concave portion and in a plane perpendicular to the central axis is of a radial dimension that is substantially the same as the radial dimension of the button concave surface.

13. A valve having a central axis and comprising, a valve seat, a valve base having an inlet and an outlet that are in fluid communication with one another through the valve seat, a diaphragm having an outer peripheral edge portion and a concave central portion opening to the valve seat, a valve body mounted to the valve base to clamp the diaphragm outer edge therebetween and mount the diaphragm to have its central portion move between a valve closed position and a valve open position permitting fluid flow through the valve seat between the inlet and the outlet, a button movable between a valve open position and a valve closed position, the valve body having a bore that includes a bore portion opening to the diaphragm central portion with the button mounted therein for axial movement between the valve open position and the

valve closed position to abut against the diaphragm central portion for moving the diaphragm central portion from its valve open position to its valve closed position, the button having a recess axially opposite the diaphragm and an outer peripheral surface of a diameter to form a close sliding fit with the body wall forming the valve body wall portion, a metal insert mounted in the recess to axially move with the button and being of a smaller diameter than that of the button and a diameter substantially the same as that of the recess, and a plunger of a smaller diameter than the insert and axially movably mounted by the valve body for abutting against the insert for axially moving the insert and thereby the button from its valve open to its valve closed position and being movable relative to the insert,

14. The valve of claim 13 wherein the button has a concave central portion that, in the valve open position, is of a transverse diameter that is smaller than that of the opening of the valve seat to the diaphragm and of a radius of curvature in a plane of the central axis being substantially the same as that of the diaphragm central portion.

15. The valve of claim 14 wherein the button in its valve closed position has a convex portion surrounding the button central portion and is curved about radii of curvature emanating from a circle in a plane perpendicular to the central axis.

16. The valve of claim 15 wherein, in a plane of the central axis, the radius of curvature of the button central portion is greater than each of the radii of curvature of the convex portion.

17. The valve of claim 16 wherein the button has a radial outer peripheral surface that intersects with the button convex surface, the valve seat has a sealing surface in a plane perpendicular to the central axis and in the valve open position, the maximum axial spacing of the button concave surface from the last mentioned plane is less than that of corresponding dimension of said intersection from the last mentioned plane.

18. The valve of claim 17 wherein the button central portion is joined to the convex portion along a circle of transition and that in the button open position, the convex portion has an annular part of minimum spacing from the last mentioned plane, the annular part being of a

minimum transverse dimension in a plane perpendicular to the central axis that is greater than the diameter of the opening of the valve seat to the diaphragm.